DOCUMENT RESUME

ED 134 848 CG 011 002

AUTHOR Bancroft, Norris R.
TITLE Science & Religion: A Syncretic Approach.
PUB DATE [75]
NOTE 25p.

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Beliefs; *Comparative Analysis; Definitions; Interdisciplinary Approach; *Religion; *Sciences; Scientific Methodology; *Scientific Principles; State of the Art Reviews; *Synthesis

ABSTRACT

The purpose of this essay is to examine some of the major similarities and differences between science and religion, as well as to attempt a synthesis to resolve what is more an apparent rather than a real contradiction of the two disciplines. The rationale for such an undertaking is based primarily upon the need for explicit definition and clarification of what exactly constitutes science and religion, and also for the purpose of illustrating those areas and ways in which science and religion overlap and are mutually supportive, as well as ways in which they are contradictory and antagonistic to one another. It is the express thesis of this essay that, while there are certain aspects of science and religion that do not appear compatible, there are probably more similarities than differences between the two. Furthermore, as it will be shown, the differences are more often of a semantic nature than any other. This will be made clear by the method of comparison and contrast, in which the definitional characteristics of both science and religion will be set forth and analyzed for their similarities and for their differences. (Author/SJL)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED134848

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Norris R. Bancroft, Ph.D.
Psychology Dept.
W.S.C.
Ogden, Utah

Science & Religion: A Syncretic Approach

Introduction:

The purpose of this essay is to examine some of the major similarities and differences between science and religion, as well as to attempt a synthesis to resolve what is more an apparent rather than a real contradiction of the two disciplines. The rationale for such an undertaking is based primarily upon the need for explicit definition and clarification of exactly constitutes science and religion, and also for the purpose of illustrating those areas and ways in which science and religion overlap and are mutually supportive, as well as ways in which they are contradictory and antagonistic to one another. One frequently hears and reads debate concerning the latter concern, i.e., that science and religion do not, indeed cannot, be other than opposed one to the other, and therefore must remain mutually exclusive in the minds and lives of their practitioners, and further, that if a man be both scientist and religionist, he must do so in different contexts and in accordance with diverse behavioral and cognitive practices, thereby either running the risk of creating within himself an unhealthy psychological schism, or forcing him to engage in certain ego and social defense mechanisms, again of a relatively unhealthy nature. It is the express thesis of this essay that, while there are certain aspects of science and religion that do not appear compatible, there are probably more similarities than differences between the two. Furthermore, as it will be shown, the differences are more often of a semantic nature than any other. This will be made clear by the method of comparison and contrast, in which the definitional characteristics of both science and religion will be set forth and analyzed for their similarities and for their differences. Only through such an explicit definitional and analytical comparative approach can the fundamental principles, tenets, issues and practices of science and religion be shown to be unequivocal. Comparative analysis, however, is only half the procedure, for to stop there leaves us more often only with elementistic bits & pieces, much like the scattered remains of a dismembered carcass. It is additionally necessary, therefore, to reconstruct the "corpse," giving it new life and flesh. Such a resurrection can be accomplished through the method of synthesis which provides not only an integration, but a more cohesive and comprehensive overview of both science and religion. This technique has otherwise referred to as syncretics, synchronistic fusion, or inductive coalescence. It is analogous to the "complimentarity principle" proposed by the physicist Niels Bohr (1958) who, though undoubtedly not the first to observe the principle, was perhaps the first to formally express it as an operational property of natural phenomena.

ED 134848 CG 011 002

The complimentarity principle, in effect, states that two or more phenomena considered independently of each other may appear to produce contradictory descriptions or explanations. However, it is usually not owing to the nature of the phenomena themselves that such a result occurs, rather it is more often merely the effect of the diverse methods of observation, measurement or description that is employed. Thus, the phenomena are found to be resolved into a single uniform description, or the two descriptions are seen to be complimentary to one another, and the phenomena turn out to be a single phenomenon. Neither of the descriptions initially made are usually completely accurate, nor exhaustive, but the diverse descriptions taken altogether from the more expansive perspective will be seen to be each correct in part, and when considered collectively from a standpoint of complimentarity, are a better ultimate description of the phenomenon under consideration. These seemingly discrepant views must not lead to contradictory predictions. The conflict, then, is seen to be only an apparent paradox and not an actual one, and the paradox is resolved by enlarging one's frame of reference wherein the illusion of separateness and opposition vanishes. For example, in physics there are different theories of the nature of light, e.g., that light is a wave-form phenomenon on the one hand, and a quantum-particle phenomenon on the other. Seen from a syncretic viewpoint these theoretical descriptions are complimentary and not opposing at all.

"Syncretism" refers to the "reconciliation or union of conflicting beliefs," and "growth through coalescence of different forms, tenets, etc." (Webster's New Collegiate Dictionary, p. 861). Buckminster Fuller (1973) writes of the "syncretist" as an individual who integrates diverse points of view and thereby enlarges his world-view. Piaget, a developmental psychologist concerned with cognitive, perceptual & intellectual development, makes reference to the process of "accomodation" which refers to the ability to incorporate new information into already existing conceptual "schemata" as well as the ability to form new conceptual schemata to pass beyond the literal and concrete stages of intellectual development into the more abstract operations of conceptual ideation and perception. Syncretic thinking has been indicated as a primary factor in creativity by several authors of that subject (Fuller, 1973; Kagan, 1967; Moustakas, 1965) and with respect to scientific creativity (Parsegian, 1973; Royce, 1964).

Somewhat in correspondence with syncretic thinking is the concept postulated by an increasing number of perceptual, cognitive and biologically oriented psychologists that man is an "information-processing" organism (Anderson, 1975; Beatty, 1975; Bruner, 1973). Literature in the area of human consciousness (Ornstein, 1973) further indicates that much of an individual's perceptual awareness of the world is "constructed."

That is, according to such authors, we are born with semi-flexible innate neurological "programs" (refer Lilly, 1972) which, through interactive experience with the environment, as well as as a function of biological maturational processes, we gradually become more narrowed and focused and thereby more adapted to relatively specific environmental conditions. Such perceptual and behavioral focusing is accomplished by psychologically constructing our world in accordance with these inborn "prewirings" or schemata as Piaget refers to them, which are then modified in accordance with our needs, drives, values, and other social & psychological experiences. This is not to say, however, that by innate we mean instinctive, for innate simply means inborn, whereas instinctive refers to a very precisely and technically defined type of behavioral sequence characteristic usually only of lower-order animals, insects, etc. As we shall see, both science and religion are ideologic systems for constructing and interpreting the world and our experience in it, hence are models for individual and collective reality definition, largely functioning through the use of certain codified and sanctioned symbols, rituals and other means of codification and expression of what is judged appropriate and acceptable by concensual validation by the "experts." In other words, the primary basis for comparison of religion and science is as world-views, living ideological systems for knowing and acting in the world. It is further the contention of this author that such world-views are complimentary when viewed as such belief & action systems.

Concerning the Definition of Religion & Science:

Failure to resolve conflicting issues often stems from an initial impasse arising out of incomplete or insufficient definition of the terms involved in the statements of the issue itself. It is advisable, therefore, to begin the examination of the relationship between religion and science with a statement of some of the more salient definitional characteristics of each of these areas. Beginning with religion, we find from Webster's dictionary the following:

> "religion, n. The service and adoration of God or a god as expressed in forms of worship." "An awareness or conviction of the existence of a supreme being, arousing reverence, love, gratitude, the will to obey and serve,..., as, man only is capable of religion." "Devotion or fidelity, conscientiousness." (p. 715).

We might remark, in passing, that man is also capable of science, and approaches that particular form of knowledge with much the same psychological attitude as he does religion. Reflection upon the term "conscientious" draws one's attention to the origins and meanings of that term as it might apply to either science or religion, or to human consciousness in general. Returning to the topic of religion, we find that religion is further defined in a variety of ways in a text by Vetter (1958), who provides an extensive compilation of the psychological nature, origin & function

or religions. Some of the conceptions of religion in Vetter's text include the notion that religion is a reflection of man's need for psychological "closure," for certitude in an uncertain world of seemingly immense possibility; as an escape from ignorance and the fear of the unknown; as an "inferiority complex" which supposedly develops out of the frustration and disappointment in attempting to cope with the overwhelming complexity of the world. Religion is further viewed as a form of magic & ritual, reflecting underlying beliefs such as ancestor worship, totemism, animism, pantheism, etc., and therefore an attempt to bring some degree of order, hence predictability and control and meaning for man in an otherwise confusing world and universe of powerful and potentially dangerous forces. Socially oriented theorists view religion as a "social opiate," used by the masses to numb their fears, or as an instrument of the knowledgeable and ruling classes to indoctrinate and control said masses. An examination of science and its nature and functions strikes us as very similar in some of these respects (Conant, 1967; Parsegian, 1973; Royce, 1964). Another view of religion is that all religion is but a theory of mystical experience. Mysticism refers to a belief that "direct knowledge of Deity, or Spiritual Truth, is attainable by man through immediate intuitive revelation, and in a way differing from ordinary sense perception or use of logical reasoning." (Webster, p. 557). Another unfortunate translation of the term "mysticism" is that of "vague speculation; unintelligible, cryptic, mysterious, enigmatic." It is probably this latter definition that is more popular and which rather completely misses the point of mysticism as intended by its practitioners. There is, however, a secret, or hidden & esoteric aspect to many religions (and no less so than in science where only the "initiated" can understand what's going on), particularly in the ancient mystery religions which were forced underground by the then-prevailing social & political powers, as well as by the dominant religion of the ruling classes, e.g., in ancient Egypt, Greece, etc. This was, and perhaps in part still is true of at least one mystical sect of Christianity, i.e., the Rosicrucians. An excellent presentation of mysticism can be found in Underhill's book by that title (1955), and also in Scharfstein's book on mystical experience (1973).

Religion, then, appears to involve a rather complex belief system created by, or revealed to, man on the basis of sensory experience, rational-logical thought, and intuitive insight or revelation. The latter aspect is frequently associated with certain altered states of consciousness, e.g., trance states, "out-of-body" experience (astral projection), dream states, etc., induced by a variety of psychoactive substances and behavioral practices. It is notable that it is the highly subjective & direct experiential aspect of such religious practice and foundation that is an

important distinguishing characteristic between religion and science, which relies more often upon experimental and relatively more objective data collection methods. More on this later. There is evident in all of religion elements of ignorance and uncertainty, with a corresponding desire to know, predict and control the forces within oneself and in the world at large. That such forces are seen as potentially knowable and controllable, if only by a member of the "priestly class," is significant, and will be referred to again in the definition and analysis of the characteristics of science also. That religion deals not only with the physical aspects of the material world and existence therein, but also with the psychological & sociological, hence the political & economical aspects of human existence as well, is also noteworthy since contemporary science has parallel interests and functions. Furthermore, both religion and science deal not only with material realms, but with the immaterial as well, e.g., conceptual & atomic physics with its concepts of force, neutrino, photon, etc., and psychology with its concepts of mind, or psyche, will, etc. It is interesting that one noted author posits that the psychotherapist of modern Western society has by & large replaced the priest (Watts, 1969). The theme of this essay, that religion and science are complimentaries in the search for a unified and more efficiacious mode of living-awareness, is echoed in some of the most ancient religious texts, e.g., of early Buddhist and pre-Buddhist Hindu literature. This formulation can be found, for example, in Bhagavan Das' text, The Essential Unity of All Religions (1932) in which he writes of the unification and identity of "scientific religion and religious science." This can be more appropriately if one views religion as an attitude, therefore a psychological orientation towards reality construction, and views the scientist as a "religious" practitioner of his discipline.

About the Author:

Before proceeding to the topic of science itself, permit me to digress briefly and offer to the reader a short developmental history of the author of this paper. This is offered merely as a form of personal testimony concerning the origins and development of my views, and also as an attempt to provide for the reader some means whereby the credibility of the author can be assessed. Opinions, like theories and wines, come from diverse sources and with varying degrees of quality. Each reader should, I feel, evaluate life in accordance with mutually agreeable criteria with respect to the validity and usefulness of what is being considered. Authors, like scientists, politicians, religious emissaries, etc., are evaluated by one another in a social-psychological process of attitude formation involving aspects of each individual's character, training, experience, and so forth, as well as with respect to relative standing in the group or society wo which each adheres. The point of this is that an academic background as a "scientist-in-training" included an exposure to diverse

points of view concerning the fundamental assumptions, methods and practices of science and scientists. Such a persepctive was also to be found in my exposure to religion, including philosophical andmetaphysical arguments of a Christian and non-Christian nature. Particularly influential were the writings of certain types of Far- & Mid-Eastern literature, e.g., Zen, Tibetian Buddhism, etc. Arguments often expressed by colleagues or other students concerning which disciplines were and were not scientific, and what was religion versus what was science, etc., prompted me to seek a synthesis and closure. Things just made more sense to me when viewing the many disciplines as parts of some integrative whole. Obviously, exposure to Gestalt perceptual psychology, as well as to "transactional" views of organism-environment interaction, heavily influenced me. Authors writing of the philosophy of science itself were equally impressive (Kaplan, 1964; Kuhn, 1970; Turner, 1965), and repeated exposure to "systems psychology" added emphasis and conviction that synthesis was possible (DeGreene, 1970; Miller, 1965; Parsegian, 1973). Academic training in psychology, including several areas of that discipline, such as physiological, experimental, mathematical, perceptual, cognitive, etc., supported by training in related disciplines such as zoology & biology, philosophy, sociology--this led to the quest for integration. It was pleasing to find many noted theologians, philosophers, and scientists of other inclinations, e.g., physics, biology, psychology, etc., and artists, poets, etc., all of a similar intention. This paper, then, has been being formulated for many years, and I hope it makes sense to you as reader.

Definitional Characteristics of Science:

Science, as we are considering it, stems from the word "scire," which means "to know." As such, science is further defined as "a branch or method of study concerned with observation, description and classification of facts, for the purpose of establishing verifiable relationships or laws among such facts" (definition mine). While this is a relatively good general definition of science, it is quite incomplete and inadequate for an in-depth understanding of science *in toto*. Science is many things, including a variety of methodologies, techniques, people, procedures, skills, existing body of knowledge, and so forth, used for the conceptual and physical organization, classification, description, interpretation and application of the information collected through the observations of the scientist. These observations of science include the organic and the inorganic, the animate and the inanimate, the physical-material and the non-material. Evidence for scientific fact and theory is based not only of direct observations, but perhaps even more often upon indirect observations, and as

such is largely conceptual & hypothetical in nature. The scientist brings to the observational field a pre-existing set of assumptions, linguistic tools, theoretical framework, etc. In combination with such factors, the fact that the scientist selects certain items & aspects of the organism, environment, etc., to observe, measure, describe, analyze, and so forth further testifies to the "constructed" and often selectively biased processes of scientific endeavor (Rosenthal, 1966). Furthermore, not all of scientific methodology is experimental as is so often assumed. Science, like aspects of religion, or other fields of study, is also experiential and involves certain non-experimental, or quasi-experimental procedures, e.g., correlational studies, case-histories and the non-experimental naturalistic observational method.

To recapitulate, science is a methodological process, with the specifics of the methodology varying according to the needs of the particular scientific discipline, e.g., physics, biology, psychology, anthropology, geology, etc. Further, science is an organized, systematized body of knowledge--observations, facts, principles, laws & theories--said knowledge again varying with the discipline. Science is also a set of procedures, techniques & "tools" or instruments, e.g., material instruments such as microscopes, telescopes, computers, etc., and non-material tools like mathematics for the description, analysis and calculated inferences of data obtained from the observations collected using the procedures, as well as conceptual tools like the notions of "force," "energy," "motivation," "mind," and so on. These latter tools are more technically referred to as hypothetical constructs or intervening variables, depending upon the nature of the connection between the concept and empirical reality. Further, science is an organized group of people, each of whom has been carefully and systematically trained ("enculturated," "socialized," "indoctrinated") in certain modes of thought and action, according to the existing paradigm of science itself. Of particular interest and importance here is the attitude with which the scientist views the world-at-large. In this respect, science is both a psychological & sociological behavioral process, frequently in the service of the socio-politico-economic powers of the society within which it operates. Science is, then, also an approach to knowledge, i.e., an epistemological world-view. There is, for example, a strictly "positivist" philosophy of science; an approach which postulates that scientific observation is somehow free of any conceptual or subjective interpretation or bias. Nietzsche called this somewhat narrow approach to science "the dogma of immaculate perception." A brief discussion of what Royce (1964) refers to as "psychoepistemology" will clarify the different knowledge bases of science & religion as well.

According to Royce, there are four basic psychoepistemologies, including the following: 1) Rationalism, including both deductive & inductive logic, & proceeding along the continuum of logical----illogical; 2) Empiricism, referring to the sensory

experience of the individual, e.g., hearing, sight, smell, taste, etc.; 3) Intuitionism, referring to the insightful or revelatory character of the mind, and usually involving a cognitive representation in terms of inner imagery, visions, or other symbolic representation. Man's intuition is the source of both religious and scientific insight, however the interpretation given to the intuitive experience, as well as the manner in which such experience is additionally checked and validated serves to distinguish the usefulness of this form of epistemology for the two disciplines. 4) Royce lists Authoritarianism as the final psychoepistemology. This method refers to what is typically a dogmatic attitude & interpretation ("asserting a matter of opinion as if it were fact")(Webster, p. 245) of the controlling powers of the discipline, e.g., scientific experts, religious texts, prophets, priests, etc.

In addition to Royce's four-fold classification of epistemologies, a fifth might be added. That is the category of affective experience, more commonly referred to as emotional interpretation and experience. The noted psychologist C.G. Jung, a one-time contemporary and colleage of Freud, makes reference to this as one of his postulated personality types. Emotion, upon close examination, appears to consist of relative degrees of all the aforementioned psychoepistemologies in that human emotion would seem to consist of cognitive awareness, therefore including aspects of both the rational (or irrational as the case might be) & the intuitive modes, along with empirical-biological sensations and processes of nervous, glandular, muscular and other bodily systems, as well as a bit of conditioning in social context which thereby reflects the authoritarian source of emotion. In fact, the authoritarian mode has a way of overshadowing each of the other modes of knowing, since all of human experience is at one time or another subject to interpretation and evaluation by societal authorities, be they of a scientific, religious, or other inclination. Authoritarian interpretations vary, of course, with the culture, the language and the era in which they exist. It is not surprising, then, to find different "logics" used by diverse socio-cultural & ethnic groups throughout the world. Cultural anthropology is notable for such findings, as the more recently developing field of psycholinguistics. It follows that the nature of the knowledge obtained, as well as the manner in which said knowledge will be obtained, interpreted and applied is, at least in part, a direct function of the authoritarian structure of the knowledge-seeking group itself. Hence the seemingly illogical world-view of certain cultural groups, e.g., Hindu, American Indian, Oriental, etc., as veiwed by a traditionally Aristotelian logic individual is not so confusing when viewed through the logic of the originator. Other world-views, such as that of the religious mystic, shaman, psychotic or schizophrenic (Caution! While these are listed together, they are certainly not the same!) are even less somprehensible to either the layman, or even to the skilled scientist, including most

contemporary psychotherapists and psychiatrists. In fact, many phenomena given high respect as advanced religious or mystical experience in some cultures would be judged as evidence of psychological abnormality by a disturbing proportion of Western world mental health professionals.

As mentioned above, the empirical-experiential method is used by the scientist and the religionist, but the crucial difference lies in the manner in which these empirical sensations are collected, described and analyzed. It is evident to both scientists & religionists that the senses can be both misleading and limited. For example, we see the mirage, or illusion, of water running across the road in the desert, and a naive person would testify to the reality of that experience. Psychophysics abounds with factual scientific evidence of the limits and illustory quality of human and animal sensory experience. The limits of the senses derive from several sources, including the anatomy and physiology of the receptor cells & organs, the neural pathways and manner in which the nervous system codes and transmits sensory information, alterations in these functions by factors such as hormonal secrations (or as produced by the ingestion of certain chemical substances, e.g., alcohol, psychoactive drugs, etc.), by techniques for sensory & mental relaxation or alertness (meditation, hypnosis, yoga, etc.), and by thought or emotion occurring in the person. Thus, not only are the senses limited and altered in what is "filtered" and processed as meaningful information by anatomic and physiologic factors, but by psychologic processes as well. Furthermore, the very nature of the physical environment and the stimulus-energies contained therein are functionally related to the senses. For example, we see only a small fraction of the entire electromagnetic spectrum as visible light with the unaided eye in a "normal waking state." Simply turning on an ultraviolet, or "black light," enables us to see many things we did not see before.

Rationalism, as we have seen, is a method for manipulating cognitive information in accordance with pre-established rules of structure, etc., in order to derive some specifiable interpretaion from that information, either for inter-personal communication, or for clarification and communication of one's experience to oneself. That the nature of the linguistic and rational-logical process varies with the culture, area of study, and decade has been amply demonstrated by several fields of study. The logic of science is reflected in its theory, and we turn to that immediately following a comment on the inutitive mode of knowing.

Intuitional knowledge may be thought of as coming from within the mind, as compared with empirical experiences which are thought of as coming from within the body, or from the sensing of the external environment by bodily receptors. Without entering what is an interesting, but never-the-less somewhat irrelevant issue of the relationship between mind & body, we find that literature in both science and religion

refer to the intuitive process as both the more natural & primitive (in the sense of being primal, or original) and immediate (without mediation as in rational logic, or language labelling), and thus functions as a more direct mode of expression of information either generated by, or received by the mind. This expression is in the form of pictures & relatively abstract symbols rather than in the derived words or language as we normally think of that system of communication. A good deal of literatrue involving the creative intuition (for example, Kagan, 1967) indicates that both scientific and religious persons use the intuition to transcend the limits of rationality in seeking answers to certain types of questions.

Theory & Knowledge in Science:

Scientific theory can be thought of as consisting of two fundamental types. First, there is the speculative and unconfirmed type of theory, which is to say theory of a strictly hypothetical nature that has not yet been exposed to the scientific procedures of experimental and empirical observation and test. This type of theory can only be postulated as potentially verifiable, and as such is of a dogmatic type, sanctioned merely on the basis of having been logically phrased and subject to test. To be phrased in testable form means that the theory, or its postulates, can be experimentally or otherwise validated or non-validated by the resultant data. Given that such a testable hypothesis is formulated, and given that some systematic means of testing the hypothesis is accomplished, with the results being subjected to scientific analysis and interpretation, the hypothesis, or theory, is no longer merely sepculative, but is now of the second type of theory--that which is tested & substantiated by 'fact.' It is notable, however, that even this latter type of theory is held only tentatively by science, and then only with a degree of prababilistic certitude since science recognizes the limits and potential error of its own methods, as well as the cautionary attitude that absolute knowledge or certainty is not achieved. This is why science does not speak of the "truth" or "falsity" of its theory or knowledge, but only of the "validity" of its findings in terms of probability statements. Scientists realize that ever-changing methods, instruments, conceptual formulations, etc., lead to ever-changing scientific facts, laws and theories. The true scientist, familiar with the underlying epistemology and ideology of his own science, continually wonders and discovers the secrets of nature. In this respect the scientist is like the religious seer or sage who realizes that religious concepts are expressed with some degree of vagueness, e.g., parables, which keep the seeker of religious knowledge in a state of constant search rather than permitting some terminal end-state. Thus, religious knowledge, like scientific knowledge, is dynamic, alive and in perpetual process of open-ended discovery. Another apparent reason for this open-endedness of these types of knowledge is that each contains a certain ineffable quality; an incommunicable mystery which can only be approximated in certain abstract symbolic form. Therein

lies the transcendent quality of scientific and religious knowledge, not only due to the limits and restrictions of the senses, of rational thought and expression, and perhaps of the human mind as well, but owing to the inherent nature of the subject matter itself. Thus it is that the conceptual physicist uses the abstract symbolic language of mathematics as the best expressional approximation to the reality of what would otherwise be expressed by the imagery of the intuitive mind itself. The scientific world-view, much like the religious world-view, can be seen as proceeding "forward" in an expansive manner, beginning with sensory experience, followed by rational and therefore typically some authoritarian interpretation, and finally to the limits of rational thought and linguistic expression where the mind is either forced to stop, or proceeds in the only way left to it--by intuition and the symbolic or literal-pictorial representation of that mode.

As another example of this procedure, the scientist might initially postulate some hypothetical idea, perhaps a hunch based upon empirical observation, or upon literature he has read, or possible coming from a dream or from an intuitive insight. This idea is then expressed in formal logical fashion in an empirically and preferably experimentally testable manner as a scientific hypothesis, which therefore has two possible outcomes in that the hypothesis can be either confirmed or disconfirmed by the data, at least with respect to some level of probabilistic certitude. By this hypothetico-deductive method the scientist proceeds, collecting data, testing the hypothesis, analyzing and interpreting the data and confirming or disconfirming the theory, possibly even reformulating the theory itself. Then, using an inductive approach, making appropriate generalizations of a speculative type for further theorizing and formulation of additional research, the scientist is carried through the realm of logical possibilities which he then systematically tests, accepting or discarding each in turn. It is while functioning in this speculative-inductive mode that the scientist most closely approximates the intuitive mode of knowledge, and the scientist may not be able to discriminate which is the source of the ideas--inductive speculation or intuitive wonder. Entering this contemplative wonder, the scientist becomes truly "lost in space," having only an occasional landmark of familiar language labelling, hypothetical construct, or intangible feeling to guide him. Frequently, from this expanded & changed perspective, arrived at ever so painstakingly by empirical and rational procedures, the scientist begins to perceive dimensions and conceptualizations not dreamed of in the highest flights of rational mentation. And it is from this larger persepctive that he must eventually retreat back to his former reality, carrying with him precious new insights and ideas to be examined, tested and analyzed as before. How very similar is this process to that of the religionist seeking his deity through the various techniques for cleansing the

senses and the mind, and for extending and finally transcending the rational-analytic limits to enter some visionary-intuitive sphere where he might begin to apprehend at least part of the wonder of the universe. He, too, becomes absorped in contemplative wonder at what cannot be expressed, and like the scientist, he, too, is forced eventually to return to another reality, hoping to one day again enter that expanded dimension to serve as mute witness to the Cosmic Display (Underhill, 1965). Such an experience is beautifully expressed by Ruysbroeck, who stated,

> "Whenlove has carried us above all things...we receive in peace the Incomprehensible Light, enfolding us and penetrating us. What is this Light, if it be not a contemplation of the Infinite, and an intuition of Eternity? We behold that which we are, and we are that which we behold; because our being, without losing anything of its own personnality, is united with the Divine Truth."

A Taxonomy of Scientific Characteristics:

1. Science is theoretical. As discussed before, much of scientific activity is of a theorizing type, involving what might be better referred to as pre-scientific intuiting, and proceeding through pre-test speculation & conceptualizing, to more formal and specifically definable methods of data collection, analysis & interpretation for hypothesis testing. From one point of view, there are no non-scientific questions, only issues which might have been formulated in a non-testable, hence non-scientific way. Even certain issues not stated in a formally testable manner often are considered part of the body of knowledge of science, awaiting the inventive mind to translate them into viable and appropriate hypotheses, or perhaps only awaiting the invention of instruments or methods to adequately test them.

Science, being theoretical in nature, is therefore also conceptual--in its language, and also with respect to the kinds of abstractions drawn about the universe and behaviors of organisms, etc., much of which is not directly observable, but only indirectly attested to by certain scientific methods. Abstract models, e.g., the DNA model, models of atomic structure, models of behavioral dynamics, etc., are used extensively in science, not as a reality, but merely as a conceptual approximation of what scientists conceive of such reality in their minds. The conceptual nature of scientific knowledge is also attested to by the cognitive mode of knowing used by the scientist. Recall that "cognitive" as used herein does not refer exclusively to cogitation, but includes the intuitive process as well as the rational-logical modes of deductive and inductive logic. The intuition of man has led man to postulate the existence of a kind of knowledge not obtainable through the rational-logical mode, rather it is knowledge obtained without recourse to that system; knowledge which is seemingly inherent in man's mind, at least through contact with what has been termed

"mind-at-large," "collective consciousness," or "cosmic intelligence," etc. Literature on this topic include that of theology, theosophy, & mysticism, as well as the more scientific literature on human consciousness (Ornstein, 1973). In referring to the concept of "intuition," it should be mentioned that the definition given in Webster (p. 442) referring to intuition as "innate or instinctive knowledge" should be used cautiously. Intuitive knowledge may be considered to be innate, if that term be restricted to that which is intrinsic, but the term "instinctive" is more technically defined in scientific literature, viz. zoology and comparative ethology.

2. Science is ideological. Theory & method in science, as in religion, or in any comparable belief system, are founded upon some ideological or epistemological assumptions. For example, in scince there are assumptions of order, predictability and causality of events in the natural universe, as well as a belief in the scientific method to discover or uncover the laws and principles according to which natural phenomena behave. Furthermore, science is pardigmatic in that there is an underlying intellectual and methodological system for the collection, classification, analysis, interpretation and application of the information comprising the body of knowledge which constitutes science itself.

3. Science is a sociological process, and as such involves definite attitudinal and value systems (Conant, 1967), as well as political & economic aspects (Farrington, 1961; Hall & Hall, 1964). Any scientist who has submitted a research proposal for financial funding has encountered the political-economic and sociological aspects of the system involved. The suitability, desirability and even feasibility of certain research topics are selectively evaluated, even censured altogether by the governing ppwers of the funding agencies. Science, like the rest of society, is also prone to its own fads and fashions as illustrated in an entertaining manner by Dunnette (1966).

4. Science is empirical, that is, scientists rely upon sensory observation whenever possible, although they recognize the limits and restrictions of human senses & attempt to extend and compensate for such limitations and inadequacies by the use of technical instrumentation, e.g., the electron microscope, which serves to increase the reliability and objectivity of the observations made. However, as we shall see, the ultimate meaning of even the most objective of instrument observations is derived from an interpretative process made in accordance with some existing linguistic & logic system, itself created by man.

5. Science is objective. The scientist operates under the fundamental assumption that there is an objective world which exists independently of the observer (cf. item #2 above "Science is ideological"). The assumptive nature of the scientists universe is apparent and at times embarrasingly exposed by the scientists themselves when they are forced to interpret the assumedly causal world in terms of correlational or

functional relationships. In view of this, and along with notions such as those of "constructed reality," the probabilistic nature of theory in science, principles of complimentarity & uncertainty in measurement and interpretation of findings, etc., we find that the objectivity of science turns out to be but a highly specialized kind of subjectivity, if only in the final analysis of human intellect and linguistics. However, it is precisely the composite of the defining characteristics of science that make scientific activity and knowledge qualitatively discriminable from other kinds of knowledge, e.g., religious knowledge.

6. Science is experimental, and this factor probably more than any other serves to delineate science from non-science. Not only through systematic observation, careful definition of concepts & principles, but through the use of systematic and controlled selection and manipulation of variables involved in the study and test of a given phenomenon does science proceed to carefully collect its data. In addition, science is replicable, which is to say that independent researchers repeat the observations and studies of one another to further validate the experimental findings, ultimately arriving at a general concensus of expert opinion for a high degree of inter-observer agreement. In the event that disagreement occurs, a final "crucial experiment" is conducted to decide the issue by weight of evidence, much as in a court of law. However, examination of the literature indicates that replication of experimentation is often not actually done, and frequently the findings of a given scientist cannot be replicated by his colleagues. In fact, careful inspection of much scientific literature indicates that many scientists have an inadequate understainding of their own tools and methods, and often conduct imporper data analysis, producing inaccurate conclusions and faulty application of the findings. A rather disturbing paper concerning the actual relevance of experimental laboratory findings to practical real-life situations has been published by Chapanis (1967).

7. Science is operational. The principle of operationism was initially phrased by a physicist (Bridgman), who stated that a concept may be defined by the procedures, methods, or operations used to measure that concept. For example, the concepts of length, or weight, or anxiety, etc., are defined by the particular techniques used in measuring each. An obvious danger here is that multiple operations might produce multiple, and possible discrepant definitions of the same concept. While this does occur in certain areas of science, the problem is to be avoided, particularly by rigorous definition and initial concensus of those who intend to use the concept in a specific manner.

8. Science is the discipline of measurement, either of a qualitative or quantitative type. There is the attitude among scientists that quantitative measurement is the preferred type of the two, although a good deal of science employs qualitative measurement of necessity (Maslow, 1946). For example, qualitative analysis in chemistry,

qualitative taxonomic classification in geology & zoology, etc., and qualitative behavioral analysis in the social sciences, e.g., anthropology, psychology & sociology. Some phenomena elude the scientist's measuring stick, however, while others can only be measured in certain dimensions at any given moment, while other aspects thereby become increasingly immeasurable. Again, a physicist, Werner Heisenberg (ref. Koestler, 1973) postulates this principle, known as the "uncertainty principle." This is also known as the "indeterminancy principle," which states that, for example, as the velocity of an electron is measured more and more precisely, its position concurrently becomes less and less exact, and conversely, as the position is more accurately specified, the velocity is less accurately specifiable. Heisenberg states that, "When we get down to the atomic level, the objective world in space and time no longer exists, and the mathematical symbols of theoretical physics refer merely to possibilities, not to facts."

9. Fortunately, or perhaps out of necessity, science is tentative in its findings and conclusions. Scientists are reluctant to draw final closure on their theories as they know the probabilistic nature of the findings, as well as the partial and incomplete nature of their existing knowledge. Furthermore, scientists are heuristic in that their research is usually productive of further inquiry. This heuristic function was alluded to in the previous discussion of the nature of scientific theory, as well as in the discussion of the probabilistic nature of scientific hypothesis testing and interpretation.

10. Science is parsimonious, i.e., it is economical and conservative in choosing its theoretical views. Given two or more theories, or hypotheses, etc., each of which says essentially the same, the scientist chooses that which is stated most concisely and simply over that which is more complex and wordy. (One wonders about the actual adherence to this principle of parsimony, however, in view of the increasing verbosity of modern science. This would seem to be more an outcome of the sociological nature of some scientific activities, however. For example, the "publish or perish" phenomenon has produced an enormous output of so-called scientific literature as the scientist feels the pressure to engage in certain professional activites like this to get and keep his position, to receive pay and merit raises, promotion, etc. The language of science might also be viewed in another interesting manner, i.e., as analogous to the secret language of the "initiated" in religious societies where only the "true believers" are permitted to enter the holy order through proper symbols and other ritualistic rites).

11. Science is pragmatic, that is, it is practical in its methods and application of its findings whenever possible. This is not to say that scientific investigation must always be so, since "pure" speculative research is also conducted. However, most

of the research in science that is funded by governmental or other agencies has at least some potential practical application in the forseeable future. As has been mentioned, science is an activity involving sociological, therefore human activities, and thus includes moral, ethical, financial, political, and other characteristics as well as the purely scientific suriousity of the ideal scientist. Science is thus a goal-directed, or teleological world-view, whose goals, methods and procedures are part and parcel of the social system within which that science functions. It is intriguing that the very philosophy of science would turn the very methods of science upon science itself in an attempt to examine and analyze the process of science in hopes of improving it. There is obviously an inherent danger in such a procedure unless the underlying philosophy is sufficiently open and adaptive to prevent a vicious circularity from occurring. As has been mentioned, however, principles such as those of probability interpretation, tentativeness, complimentarity, heuristics, and the attitude that scientific conclusions are not to be dogmatically or absolutely accepted in terms of their "truth" or "falsity," rather are to be held with respect to the relative degree of confirming evidence, all serve to promote a healthy openess and inquiring scepticism in science.

12. Finally, and certainly not of least importance, science is serendipitious. That is, scientists do not always proceed in a carefully calculated, logical and systematic manner in discovering the nature of things. Numerous scientific discoveries have been just that--discoveries of an unexpected and accidental type, often occurring while the scientist is engaged in a partially, or totally unrelated activity. Inherent curiousity and the ability to notice and attend to oddities and irregularities, and the corresponding ability to conceptualize and treat the unexpected as potentially significant, mark the discoverer and creative genius in science as in any other field.

The preceding has been an attempt to list and briefly discuss some of the major defining characteristics of science and scientists. These characteristics are by no means mutually exclusive or independent of one another, rather must be taken collectively as an integrated, inter-dependent and mutually reinforcing set of traits, much as the concepts of physics are, e.g., force, work, energy, mass, etc. This is necessary if science as an organized world-wiew is to be understood in all of its complexity. Whether this synthesis, or "synectic scheme" is meaningful to the reader or not depends in part upon the conceptual ability of that reader. He who has ears to hear, let him hear; he with a conceptual schema to comprehend, let him comprehend.....

Conclusions:

With the foregoing statements describing the nature of religion and science, let us inquire after the essential similarities and differences between the two. Lest the

reader be led to the incorrect conclusion that I am trying to make an identity of science and relgiion, let me state unequivocally that I am not. There are similarities to be sure, but there are significant differences as well. I have tried to point out, however, that the extreme distinction made by many between science and religion is often unfounded, and is more often than not postulated out of a degree of ignorance of the essential nature of either science or religion, along with a pre-disposition to overlook the complimentarieties that exist in them.

Similarities between religion and science include the fact that both are belief systems concerned with the nature and workings of phenomena of objects, organisms and eventa at various levels of manifestation, including the material and non-material. Both make fundamental assumptions concerning the manner in which things come into material form, exist as such and pass out of such form. These initial assumptions can be seen to be quite similar in certain respects (LeShan, 1969), although the manner in which they are described and expressed may differ. Not only the subject matter, but the people who adhere to, support and perpetuate that subject matter bear striking similarities with respect to their social and psychological functioning. Attitudes and behavioral practices ranging from dogmatic certitude through strong likelihood of possibility to rather complete uncertainty and disbelief exist in both religionists and scientists. There exist within each system systematic and tested methods for personal and collective exploration and confirmation of the values, beliefs and practices of the participants. This latter comparison is most obvious in the highly developed discipline of "yoga science" and science <u>per se</u> than in religious forms which rely predominantly upon prayer, faith, etc., and not upon the experiential techniques of some of the Eastern methods. It is with respect to these latter methods that contemporary science has most profitable turned for experimental confirmation of what were formerly considered to be only religious or metaphysical issues. As for the ideological aspects of either religion or science, an in-depth analysis of this topic should convince the careful reader and thinker that there are probably more similarities than differences, especially at the level of conceptual science, e.g., physics, biology, psychology, etc.

Some of the more significant differences between science and religion lie partly in the attitudes & behaviors of the practitioners, in some of the underlying assumptions of each discipline, and in the way in which each belief system arises and is followed. However, the primary difference appears to be in the degree of emphasis placed upon the requirements of the scientist that observations, theory, etc., be subjected to empirical as well as conceptual examination, and to experimental test

through systematic manipulation of relevant variables, with the additional stipulation that independent experts replicate the studies of each other to arrive at a common concensus of validated opinion. Further emphasis upon precautions of objectivity and measurement, etc., also serve to distinguish science from most of religious practice. Again, however, the same kind of cautions and procedures are openly advocated and followed by the founders and practitioners of certain direct experiential-experimental religions, such as Buddhism.

In summary, there appear to be striking similarities between religion and science, as well as differences, and the similarities and differences are related to the level and degree of understanding of the two respective belief-systems. There are certain advantages and disadvantages of each as a world-view, particularly if taken alone and in isolation from other complimentary world-views. It is the thesis of this paper & the contention of this author that science and religion are complimentary rather than antagonistic world-views. In the words of Albert Einstein,

> "The most beautiful thing we can experience is the mysterious. It is the source of all true art and science....This insight into the mystery of life, coupled though it be with fear, has also given rise to religion. To know that what is impenetrable to us really exists, manifesting itself as the highest wisdom and the most radiant beauty which our dull faculties can comprehend only in their most primitive form--this knowledge, this feeling, is at the center of true religiousness. In this sense, and in this sense only, I belong in the ranks of devoutly religious men....It is enough for me to comtemplate the mystery of conscious life perpetuating itself through all eternity, to reflect upon the marvelous structure of the universe which we can dimly perceive, and to try humbly to comprehend even an infinitesimal part of the intelligence manifested in nature."

Appendix A

The Nature of Scientific Theory

Definition of "Theory":

Various definitions of what constitutes scientific theory exist, however, each definition may be seen to fall into at least one of the following categories, where "theory" refers respectively to 1) any aspect of the strictly formal & conceptual processes of science as contrasted with the strictly empirical, observational processes; 2) any generalized explanatory or descriptive principle; a statement of functional relationship between or among variables; 3) a set of logically organized and inter-related deductive principles or statements; 4) a collective set of summary statements which give order in an essentially descriptive manner to the laws or principles which have been empirically derived or developed in some subject matter. Rotter defines theory as "the devising of hypotheses to account for facts." In this sense, theory begins with empirical observation, followed by a devising of hypothetico-deductive statements which are subjected to experimental &/or experiential test. Theory in this sense leads to generalization and inductive statements for the further construction of hypothetical constructs and therefore eventually to concepts having a greater degree of operational specificity, e.g., intervening variables which have some definite empirical referent, and which can be operationally defined in terms of an empirical measurement procedure. Thus, theory is both a methodology and a set of interconnected hypotheses arrived at through the application of said methodology. Braithwaite (in Marx, 1951) has defined theory as consisting of

> "...a set of hypotheses which form a deductive system; that is, which is arranged in such a way that from some of the hypotheses as premises all the other hypotheses logically follow. The propositions in a deductive system may be considered as being arranged in an order of levels, the hypotheses at the highest level being those which occur only as premises in the system, those at the lowest level and those at intermediate levels being those which occur as conclusions of deductions from higher-level hypotheses and which serve as premises for deductions to lower-level hypotheses."

In further speaking of theory as a system, Heidbreder (1933) has stated that theories are to be "regarded as a production of living creatures, working in the midst of doubt, concern and incomplete knowledge, to achieve better adjustments to the particular circumstances that surround them." Heidbreder elaborates on this by adding,

> "This means, for one thing, that systems of psychology must not be regarded as altogether impartial and unemotional constructions, determined solely by logic and evidence. On no account is it wise to consider systems apart from the particular situations that give rise to them--from the traditions, conventions, standards, prejudices, and at times the rank personal feelings which constitute their background."

Heidbreder's comments are no less true of scientific theory.

In theorizing, we begin with observational data, from which we may ascend to some point in the theoretical network, proceeding via definitions, hypotheses, constructs, etc., to other points, eventually to descend once again to the level of observational data. Every formal scientific definition, whether formally encompassed by a theoretical framework or not, conceals within itself some elements and implications of a theoretical proposition, namely that the objects, events or processes defined belong together in that sense that treating them as in some degree mutually compatible under the definition facilitates the discovery of lawful relationships among them. As Marx has stated,

> "Direct" observation is generally agreed to be a fundamental task of natural science. Unfortunately, however, answering scientific questions simply by means of direct observation and measurement is not always reasible. Many phenomena appear to be too remotely and too tenuously related to the immediately observable variables to permit a strictly empirical approach. Further, some problems of underlying relationships cannot easily be attacked by empirical techniques alone. For these reasons all modern natural sciences have developed a large number of inferentially derived propositions or theories which are ultimately based upon, but not reducible to, concrete empirical data." (Marx, 1963, p. 4).

According to Marx (1963), the three basic aspects of scientific theory are as follows:

1. Hypotheses, ranging in their degree of testability from low(intuitive level) to high (rigorous hypothesis level).
2. Hypothetical constructs, ranging in the degree of operational specificity from low (much surplus meaning) to high (explicit meaning & specific empirical referents).
3. Observations, ranging in the degree of experimental control from low (with high ambiguity) to high (specifically experimentally produced & defined).

Functions of Scientific Theory:

Theory serves as a guide for research by indicating areas of study that are most likely to be productive of functional or lawful relationships. Theoretical concepts which are not so productive turn out to be scientifically sterile, no matter how meticuouous the observations made of them, or the inferences drawn about them. Theory increases the meaningfulness of research findings by integrating such findings into a more meaningful composite, an integrated network of interrelated concepts and hypotheses. As such, theory provides for more meaningful and accurate prediction and control of the phenomena under study. Scientific theory thus serves to summarize existing data, to provide a comprehensive explanatory & descriptive formulation for observations and principles of similar association, & to serve as a predictive basis for the yet-to-be-observed. Theory is both a tool, or methodology, and a resultant objective of the methodology it constitutes.

As a tool, scientific theory guides observations & directs research activities. The heuristic value of theory serves to generate new ideas and areas of investigation. As a goal of science, theory serves to incorporate known findings within an existing logical framework, thereby synthesizing that body of knowledge used by the scientist as a foundation for validation of new findings, as well as promoting the heuristic function of theorizing as indicated above. Theory is thus an economical, or parsimonious way of abstracting, codifying, summarizing and storing information for interpretation and potential application.

Evaluation of Scientific Theory:

Scientific theory is evaluated with respect to a number of criteria, including factors such as pragmatic usefulness, logical consistency, and so forth. One outline for the evaluation of theory is as follows:

I. Structure.

A. Delineation of empirical area for study, including definition of the field & the relevant problems & questions.

1. Data language of the theory: Is the language explicit and operational for expedient application.

2. Specification of variables: How explicit are the independent and dependent variables to be used in experimentation? How are these variables related to the fundamental hypothetical constructs or intervening variables contained in the theory?

B. Theoretical concepts:

1. Primitive terms: Are the terms of the theory reducible to primitive, specifiable & operational physical procedures, preferably with explicit objective methods of measuring them?

2. Major theoretical constructs: Do these constructs serve only a summarizing function, or are they of heuristic value in being related to the testable hypotheses generated by the theory? Are the constructs sufficiently tied to operational procedures to make them intervening variables?

3. Relationships between or among theoretical concepts: What is the functional relationship between the concepts and constructs of the theory? What degree of operational specificity have such relationships to the empirical observations made in accordance with the theoretical hypotheses?

II. Methodological Characteristics:

1. Explicitness of terms, constructs, etc. (see above).

2. Type of measurement, i.e., qualitative or quantitative.

3. Reliability & validity of theoretical constructs.

4. Utilization of conceptual paradigms or other models, e.g., math models, etc.

III. Empirical Content:

A. Type & range of data covered.

B. Specificity of predictions generated by the theory.

C. Failures & successes in handling the data obtained.

1. Has the theory made predictions, deductive or inductive, of additional data and phenomena possible?

2. To what degree have the theoretically generated predictions been confirmed or disconfirmed?

3. How well does the theory account for facts obtained by competing, or conflicting theories?

4. What special limitations or virtues does the theory contain?

References on scientific theory:

Arnoult, M.D. Fundamentals of Scientific Method in Psychology. W.C.Brown, 1972.

Kaplan, A. The Conduct of Inquiry. Chandler Publishing Co., 1964.

Kuhn, T.S. The Structure of Scientific Revolutions. U. of Chicago Press, 1970.

Marx, M.H. Theories in Contemporary Psychology. MacMillan Co., 1963.

Turner, M.B. Philosophy & the Science of Behavior. Appleton-Century-Crofts, 1965.

Bibliography for paper on Science and Religion

Beatty, J. Introduction to Physiological Psychology: Information Processing in the Nervous System, Brooks/Cole, 1975.

Bhagavan Das. The Essential Unity of All Religions. Theosophical Press, 1939.

Bruner, J.S. Beyond the Information Given, Norton Press, 1973.

Chapanis, A. The relevance of laboratory studies to practical situations, Ergonomics, v. 10, #5, 557-577, 1967.

Conant, J.B. Scientific principles and moral conduct, American Scientist, v. 55, #3, 311-328, 1967.

Dunnette, M.D. Fads, fashions and falderol in psychology, American Psychologist, pgs 343-352, April 1966.

Farrington, B. Greek Science. Pelican Books, 1961.

Fuller, R.B. Intuition. Anchor Books, 1973.

Hall, A.R. & Hall, M.B. A Brief History of Science. Signet Science Library, 1964.

Kagan, J. Creativity and Learning. Beacon Press, 1967.

Kaplan, A. The Conduct of Inquiry. Chandler Publishing Co., 1964.

Koestler, A. The Roots of Coincidence: An Excursion into Parapsychology. Vintage Books, 1973.

Kuhn, T.S. The Structure of Scientific Revolutions. International Encyclopedia of Unified Science, Vol. 2, #2, University of Chicago Press, 1970.

LeShan, L. Physicists and mystics: Similarities in world view. Journal of Transpersonal Psychology, vol. 1, #2, 1-20, 1969.

Marx, M.H. Theories in Contemporary Psychology. MacMillian Co., 1963.

Maslow, A.H. Problem-centering vs. means-centering in science, Philosophy of Science, Vol. 13, #4, 326-331, 1946.

Miller, J.G. Living systems: Basic concepts, Behavioral Science, vol. 10, #3, 193-237, 1965.

Miller, J.G. Living systems: Structure & Process, Behavioral Science, vol. 10, #4, 337-379, 1965.

Miller, J.G. Living systems: Cross-level hypotheses, Behavioral Science, vol. 10, #4, 380-411, 1965.

Ornstein, R.E. The Nature of Human Consciousness: A book of readings. W.H. Freeman Press, 1973.

Platt, J.R. Strong inference, Science, vol. 146, #3642, 347-352, Oct., 1964.

Parsegian, V.L. This Cybernetic World of Men, Machines, and Earth Systems. Doubleday-Anchor Books, 1973.

Royce, J.R. The Encapsulated Man. Van Nostrand, 1964.

Scharfstein, Ben-Ami. Mystical Experience. Penguin Books, 1973.

Turner, M.B. Philsophy and the Science of Behavior. Appleton-Century-Crofts, 1965.

Underhill, E. Mysticism. Meridan Books, 1955.

Vetter, G.B. Magic and Religion: Their Psychological Nature, Origin and Function. Philosophical Library, New York, 1958.

Watts, A.W. Psychotherapy East and West. Ballantine Books, 1969.

Lilly, J.C. Programming & Metaprogramming in the Human Biocomputer. Bantam Books, 1972.

Moustakas, C. Creativity & Conformity. Van Nostrand, 1965.

Rosenthal, R. Experimenter Effects in Behavioral Research. Appleton-Century-Crofts, 1966.

Taylor, J.G. The Shape of Minds to Come. Penguin Books, 1975.